variations in the different species, at least in many cases, bear a close relation to the conditions of growth; so that those species which are generally found in rapidly flowing water formed rhizoids under all conditions and the rhizoid formation may be considered as a specific character. An entirely opposite condition exists in those species of Spirogyra which in no case formed organs of attachment (S. varians, Weberi and others not specifically named). *Spirogyra fluviatilis* and *Vaucheria clavata* may be regarded as a mean between the two extremes; these formed rhizoids but in contact cultures only, and he suggests that these might gradually have acquired this ability from species in which the necessity for rhizoids was originally wanting. This view confirms that of Klebs,[2] who suggests that *V. clavata* might be regarded as an offshoot of *V. sessilis* which has been removed from its accustomed habitat into rapidly flowing water.

The experiments were conducted in the laboratory of Prof. Klebs of Basel and the results are published in pamphlet form. Two plates illustrating the various results are appended to the text.

The work gives evidence of careful thorough investigation and it will be read with interest by all who have made a study of these forms of algæ.—BERTHA STONEMAN.

Investigations on bacteria.[3]

Under the above general title, Alfred Fischer has recently published a lengthy paper which, in part, deals with a subject that has received but scant attention from bacteriologists. The paper is divided into four parts, which treat respectively of plasmolysis of bacteria, physiology of motile organs, morphology of cilia, and systematic bacteriology.

In the first three parts, the author draws attention to many points of interest that he has observed in his studies, and discusses the relation of the same to the different theories that have been advanced from time to time.

I. He brings further proofs to substantiate his earlier claim[4] that the bacterial cell is subject to plasmolysis like the higher plant forms. Plasmolysis frequently occurs in the preparation of ordinary cover glass mounts where the evaporating

[2] Zur Physiologie der Fortpflanzung von Vaucheria sessilis. Verhandl. d. naturforsch. Ges. in Basel **10:** —. 1892.

[3] Untersuchungen über Bakterien, Jahr. f. Wiss. Bot. **27:** 1–163. 1895.

[4] Ber. d. konigl. sächs. Ges. d. Wiss. —: 52. 1891.

drop containing the bacteria undergoes a concentration of saline material sufficient to induce plasmolytic action. The lacunæ and uncolored areas so often noted in many different species of bacteria, when stained indicate where the protoplasm has shrunken from the limiting membrane under the action of the salt solutions. In certain instances plasmolyzed preparations recovered their turgor by the permeation of the salt solution into the bacterial cell. The protoplasm of the same species, however, is not permeable to different salts in an equal degree.

The importance of these observations on plasmolysis are considerable, as they have a direct bearing on the theory of the nature of the bacterial cell.

According to Bütschli[5], that part of the cell that absorbs the basic aniline dyes with ease is nuclear in its character. This large nucleus is surrounded by a membrane that does not easily stain. The cytoplasm of the cell is either entirely absent or is reduced to a mere film between the two layers.

In his preparations, Fischer finds an evident contraction of the interior cell substance when submitted to the influence of different salt solutions similar to those observed with higher plant forms when plasmolyzed. According to him, no nucleus has yet been determined. His results homologize the bacterial cell with that of higher plants as far as the cell elements are represented, and also with reference to plasmolytic action.

II. The view has been advanced that the cilia of swarm spores of different plants, and also bacteria, are protoplasmic processes that are extruded from the main part of the cell through minute openings in the limiting membrane, and that these filiform appendages are capable of being withdrawn entirely within the cell proper. If this were so, plasmolyzed bacterial cells would hardly be expected to show any appreciable degree of motility, yet, a number of different motile forms plasmolyzed in weak solutions (2.5 per cent. KNO_3, 1.25 per cent. NaCl), showed no cessation of movement. If strong solutions were used, motion ceased immediately. This was not, however, on account of the retraction of the cilia, but a rigor caused by the concentration of the solution.

The addition of disinfectants (carbolic acid, 0.1 per cent.) in proportions insufficient to cause a cessation in development, likewise sufficed to produce a similar state of rigor.

[5] Bau der Bakterien. 1890.

III. In taking up the question of the morphology of the cilia, details are given of a method of staining that is a simplification of the Löffler method.

After the general discussion of cilia and their separation into two classes, polar and diffuse, observations are noted on the changes that take place in the form and character of the cilia under different phases of development.

In several instances, sporulation took place without a cessation in motility, and in some cases degenerate phases of development, such as involution forms, were still characterized by movement.

The cilia are to a certain extent independent of the main protoplast of the cell. Ability of motion and contractility reside in the cilium itself, likewise a certain irritability which sometimes brings about an increase of motion, sometimes a rigor. At the same time cilia are not completely independent of the protoplast as they lose their motility if not in contact with the main body of the cell. Under the influence of plasmolytic action, they remain in close connection with a small fragment of the protoplasm within the cell.

IV. The final part of the paper takes up the vexed question of the systematic part of the science. In this, Fischer favors a system of classification founded on a morphological basis rather than an attempt to use physiological data for differential characteristics.

His proposed scheme is based (1) on the presence and arrangement of the cilia, (2) the formation of spores, and (3) the morphology of the spore-bearing cell.

A marked feature of the system is the use of the same root to designate the genera having the same form of cell although differentiated into various subfamilies on account of other characteristics. Thus, the genera, Bacillus, Bactrinium, Bactrillum, and Bactridium are all cylindrical spore-bearing rods characterized by a difference in arrangement of motile organs. The different genera in each subfamily are likewise characterized by the use of a uniform suffix, as for instance, the subfamily Bactriniei, has its genera terminating in *inium* (Clostrinium, etc.), while the genera of the coordinate divisions Bactrillei and Bactridiei end respectively in *illum* (Clostrillum) and *idium* (Clostridium).

This arrangement necessitates a large number of genera and by this method the author hopes to relieve the overbur-

dened condition that is found in the present genus Bacillus. The logical nature of this scheme is praiseworthy but the present necessities of our classification hardly warrant the formation of a number of genera for which there are no known representatives.

The fact that the author himself is forced to note under many of the genera that "bisjetzt ist kein Vertreter dieser Gattung bekannt" and also that under the genus Bactridium, "hierher scheinen eine grössere Zahl von Stäbchenbakterien zu gehören" is evidence of the inherent weakness of the system.

The difficulty of founding any system of classification upon a characteristic so difficult to determine with accuracy as the presence and arrangement of such delicate organs as the cilia of bacteria is apparent. Even with much simplified methods of staining, the study of these motile organs is not an easy task and when used as a basis for classification would cause more confusion than now exists. The author ignores completely all reference to a similar system proposed by Messea[6] in 1891 which failed of acceptance on account of the many new difficulties that it introduced. Desirable as a system would be that is based on morphological data entirely, none has as yet been presented that is as convenient and practical as those that employ physiological characteristics in addition to the morphological variations of the cell.—H. L. RUSSELL.

[6]Contribuzione allo studio delle ciglia dei batterii e proposta di una classificazione. Rev. d'Igiene **1**: —. 1891. [No. 14.]